Center for Urban Horticulture
University of Washington
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Cooperative Extension
Washington State University
Winter, 1990

LANDSCAPE MAINTENANCE SEMINARS

... for the landscape professional

Cooperating: Center for Urban Horticulture, University of Washington; Cooperative Extension Service, Washington State University; Edmonds Community College; South Seattle Community College.

Urban Trees: Construction Impacts

Robin Morgan, Urban Forester

Thursday, January 25, 1990
9:00 am to Noon; $13
Center for Urban Horticulture

Before a street tree is planted, site selection and events related to road construction will determine the environment in which the tree will grow. Such things as water, air, and nutrient availability will be impacted by construction. Understanding the planning and logistics of construction projects will help the horticulturist to develop successful strategies for planting and managing trees.

Robin Morgan is Urban Forester for the County of Sarasota, FL, and author of *Trees for Eugene* and *An Introductory Guide to Community and Urban Forestry in Washington, Oregon, and California.* She will illustrate relevant construction practices and their impacts on tree health and lead a discussion panel which includes members from municipal planning, construction, utility; and arboricultural areas.

ProHort editorial staff
Dr. John A. Wott
George J. Pinyuh
Eric Nelson

WSNLA/CUH Plant Management at the Retail Level

Wednesday, February 28, 1990
9:00 am to 4:00 pm; $35
Center for Urban Horticulture

Presented in co-operation with the Washington State Nursery and Landscape Association, this day-long program examines issues of plant management in the retail setting.

Practical information will be provided on watering, using soil mixes, fertilizing, winterization, pests and diseases, handling balled and burlapped plants, and more. Emphasis will be given to information which can be passed-on to the retail customer to help them to be successful after the sale.

This program qualifies for three hours WSDA pesticide license recertification credit. To request registration forms, call 1-800-672-7711 (WSNLA), before February 14, 1990.

Annuals: New Approaches

Tuesday, March 20, 1990
6:30 to 9:30 pm; $13
Center for Urban Horticulture

What's new in annual plants?
Marianna Metke, of Skagit Gardens, shows plant selections for color, foliage effects, and extending the season.

Special topics in maintenance
Keith Degler, of Evergreen Services Corp., illustrates comon maintenance problems and discusses their solution.

Innovative container plantings
Peggy Campbell, of Molbak's Nursery, illustrates new ideas for the design of container plantings with annuals.

Other Educational Resources

South Seattle Community College
Horticulture Courses, Winter, 1990.
Weekdays: Greenhouse Operations, Winter Plant Identification, Plant Propagation, Drafting, Landscape Design/Construction, Contracts & Specifications, Plant Diseases. Evening classes: Pruning, Small Engine Repair, Irrigation Systems. 764-5336.

Edmonds Community College
Horticulture Courses, Winter, 1990.
Weekdays: Winter Plant Identification, Soils, Pesticide Laws and Safety, Pruning, Propagation, Landscape Design, Sprinkler Design, Landscape Renovation, Job Training, Greenhouse, Early Rhododendrons. Saturdays: Pruning. Evenings: Plant Plant Identification, Grafting, Wholesale Nursery Operations, Retail Nursery Operations, Landscape Materials. 771-1608.

Lake Washington Voc-Tech
Horticulture Courses, Winter, 1990.
Weekdays: Environmental Horticulture, Floral Design/Flower Shop Assistant. Evenings (short courses): Floral Design, Pruning, Turf Management, Nursery Business Management, Residential Lawn Care, Propagation, Greenhouse. 828-5627.

Pesticide licensing credit.
An evening class entitled "Lawn Renovation," offered through the Center for Urban Horticulture continuing education program, carries two hours of WSDA pesticide license recertification credit. Ciscoe Morris, grounds supervisor at Seattle University, will teach the class, to be held on Thursday, March 15. Preregistration is required. For registration information, call 545-8033.

Registration information
See Page 3

Root Facts — A Review

Van M. Bobbitt
Cooperative Extension Service

Insufficient understanding of the root systems of trees has led to the development of management practices which are ineffective or even detrimental to tree health. By understanding and applying research-based information developed over the past decade, landscape managers can modify their cultural practices to the benefit of trees.

Horizontal Root Spread
Tree roots spread much farther than once thought, usually growing well beyond the dripline (branch spread). Studies have shown root spreads ranging from 1.68 times the dripline radius for *Fraxinus pennsylvanica* to 3.77 times for *Magnolia grandiflora*. This has led to revised recommendations for the application of fertilizers and herbicides around trees. Fertilizers should be applied not only within, but also beyond the dripline. Potentially harmful herbicides once carried instructions that they not be applied within the dripline of trees; it is now clear that this is not an adequate margin of safety.

Root Depth
Deep root systems are uncommon in shade trees, and most of the absorbing roots are in the top few inches of soil. Urban trees often grow in compacted, oxygen-poor soils to which they respond by growing roots closer to the surface. Research with *Gleditsia triacanthos* indicated that trees in heavy soils may benefit from shallow planting, a few inches above grade.

Root-Zone Temperatures
The optimal range for root growth is 16-27°C (61-81° F). Roots of container-grown trees will be exposed to higher temperatures which could be lethal. High root-zone temperatures may develop from surrounding paving, thus impairing the vigor of the tree.

Root Competition
Trees may be stressed from competition with other plants. Sod growing in the root zone of trees can inhibit fine root development, especially on recently planted trees. Most of the detrimental effects can be avoided by keeping turf cleared at least 12 inches away from the trunks of young trees.

Pruning and Roots
Substantial shoot pruning of transplanted trees used to be recommended to balance the shoot and root systems. New research indicates that severe pruning can delay the regrowth of roots, and suggests only light corrective pruning and adequate watering.

Staking
Staked trees develop smaller root systems than unstaked trees. Therefore, avoid prolonged, rigid staking . If temporary staking is required, use a flexible method, which allows some trunk movement.

References
Harris, R.W., 1983. Arboriculture: Care of Trees, Shrubs, and Vines in the Landscape. Prentice-Hall, Inc., Englewood Cliffs, N.J.
Schnelle, M.A., J.R. Feucht, and J.E. Klett .1989. Root systems of trees - facts and fallacies. Journal of Arboriculture 15 (9): 201-205.

Root Diseases of Native Trees

George Pinyuh
Cooperative Extension Service

Several root diseases of native trees occur here in western Washington. They are not easy to diagnose and, by the time they are obvious on a big old Douglas-fir or western hemlock, it's usually too late to do anything about it except to remove the sick tree.

Not only are the symptoms, such as chlorosis, reduced growth, poor needle production and declining crown similar for all of these root rots, they are also pretty much what you see when trees are suffering from other problems. Drought, poor drainage or aeration of the roots caused by grade change or soil compaction, winter damage, severe insect attack, and other things can all cause similar responses in native trees.

These root diseases of our native conifers are prevalent in areas where homes have been built in wooded areas during the last 25 years. The disease organisms have been there all the time, even when trees may only recently have shown symptoms. Dead stumps and roots left in the ground when sites were cleared are often a repository where the fungus organisms can exist for more than 50 years. From these sites the pathogen can infect the roots of living trees.

Except for the symptoms on the tops of the trees, which are often very subtle, it's almost impossible to diagnose a potential problem. The first hint of trouble is often when a big old fir or hemlock comes down in a windstorm. It's usually then, when the root, crown, and major buttress roots can be seen, that symptoms of disease are seen.

Fomes annosus can kill both Douglas-fir and hemlock. It can attack living trees from the roots of nearby stumps and trees when spores germinate on a new stump or wound and grow down into the neighboring tree's root system.

Since freshly cut stumps of healthy trees are often the beginning of the problem, some experts recommend treating all cut stumps, especially of hemlock, immediately after the trees have been felled in order to prevent *Fomes* spores from germinating on the surface. Borax is the stuff to use and it can be applied in the form of a borax soap available at supermarkets. If this is done in winter, cover the stump with plastic to prevent the borax from being washed off by rain. This will not eliminate the disease from an infected tree. Only stumps from healthy hemlocks can be protected with the borax.

Although it's not really easy to tell *Fomes* in a tree that has come down, the presence of soft and spongy roots is a pretty good diagnostic symptom. The decayed wood is often a white to cream color.

Phellinus weirii is another fungus that causes much loss of conifers in our area; this disease kills a fair number of Douglas-firs. Phellinus is often called laminated root rot because of the peculiar separation of the wood into sheets at the annual rings. A brown, felt-like material can often be seen between the sheets of decayed wood.

Laminated root rot-infected trees will often blow down, breaking off cleanly at the crown. The roots are not often lifted from the soil. This disease does not exhibit the soft, rotted tissue that *Fomes* often does.

Armillaria mellea is a third common fungus that attacks the roots of local trees. This disease can kill trees of all ages whereas the two former ones seem more often to be associated with older and larger trees.

Armillaria can often be diagnosed by the brown, honey-colored mushrooms that develop in groups around the bases of infected trees in fall. Dark brown to black, flat shoestring-like structures, looking a bit like roots, are also often present in the soil around the roots and up under the bark. Creamy, white sheets of fungus growth can also usually be found between the bark and wood of an infected tree. Sometimes diseased trees will have large amounts of resin at the crown and in the soil nearby.

Any abnormal symptoms in trees, especially big ones which might do damage if they come down, should be investigated. If it is determined that any of these root rots are present in a tree, it's best to remove the tree. None of these diseases is curable at the stage one is likely to become aware of them, although vigorous, healthy trees can sometimes isolate the pathogen and immobilize it during the early stages of invasion.

Healthy trees may be able to coexist with these pathogens for long periods of time and remain disease free, but all it takes is one environmental event which puts stress on a plant for it to come under attack. Although we don't have much control over very cold winters or long droughts, we can control some changes to the soil conditions. Adding to, or taking away, soil from the extended root system of an old tree, or laying concrete or asphalt over a tree's root zone, or running back and forth over the soil with heavy equipment, is unsafe. Also avoid wounding tree trunks with lawn mowers or other mchines. Large animals like horses can also severely damage bark. Avoid stressing trees; keeping them healthy may help in keeping them vertical. The best defense against root diseases is a healthy tree.

A Bristly Fir

Timothy Hohn
Center for Urban Horticulture

Living in the Pacific Northwest, it's hard not to take conifers for granted. The hazy, blue-green tapestry of patchwork vegetation clothing the Cascade and Olympic mountains may leave many of us claustrophobic about conifers. But why fight the genius of the place? The climatic conditions that nurture our stately coniferous forests provide us with an obviously ideal environment for cultivating interesting and exotic members of this primitive group of plants.

Stalking the central California coast in 1831, Thomas Coulter was lured to the rounded peaks and rocky slopes of the Santa Lucia mountains by a tree of superb silhouette. Distinctive, even from a distance, with its spire-like crown narrowing to a sharp point, the bristle cone fir, *Abies bracteata*, is a narrow endemic to specific locales in the Santa Lucia mountains of Monterey County, California. I recently "discovered" a threesome of *Abies bracteata* ("bearing bracts" on the cones) while inventorying cold damage in the Washington Park Arboretum. They guard the boxwood (*Buxus* sp.) and spindletree (*Euonymus* sp.) collections with a commanding stature.

The rarest and most unusual species in the genus, I at first did not know what to make of these plants. With distinct and anomalous characteristics for a true fir, *Abies bracteata* is even classified separately from other species of *Abies* into its own subgenus, *Pseudotorreya* (Liu, 1971). The phylogeny, or evolutionary history, accorded this classification makes the bristle cone fir the most primitive of true fir descendants. The needles are the largest of any species in the genus, at 3-6cm long and 3mm wide. They are sharply pointed at the tip, similar only to *A. cephalonica* in this regard, and shiny green above with bright white bands of stomates underneath. The winter buds are, perhaps, most anomalous in being long, 1.5-2.5cm, and fusiform or spindle-shaped - like those of a beech (*Fagus* sp.) - rather than short and rounded. The specific epithet, "bracteata", refers to the bizarre, elongated bracts which protrude from between the cone scales like ominous, defensive bristles. The cones themselves, like those of others in the genus, are rounded and borne on the upper sides of the highest branches. A crop of cones can be so heavy as to bend down the branches and, hence, camouflage their true fir-like orientation. As the cones begin to shatter in October, the ground underneath the trees is lightly coated with shiny winged, red-brown seeds.

The three bristle cone firs at the Arboretum were part of an original shipment of six, each 9"-12" tall, that arrived in 1956 from Mr. John Drueker of Fort Bragg, California. Three of these were planted out in 1960 when they had reached 3' in height. These trees are now nearly 40' tall with graceful branches sweeping the ground to a diameter of 15'. They are symmetrically branched in regular whorls about the trunk and carry semi-pendulous branchlets clothed in stiff needles.

The Arboretum specimens of *Abies bracteata* are densely foliated with an almost woolly appearance. The needles are slightly 2-ranked and a shiny green to yellow-green on top. Standing away from the trees, especially on the lighted side, the needles appear to be thinly "iced" with a bright aura of light. Upon closer inspection - lift one of the branches to examine the underside - one can see that the "aura" is created by distinct, silvery white bands of stomates on the undersides of the needles.

Our trees are producing cones at their very tops where they may be closely observed with binoculars. The glistening drops of resin glued to the ends of the long, bristle-tipped bracts, should aide you in spotting them. Bristle cone firs generally flower in May, mature their cones in September, and disperse seeds in October (Lui, 1971). Very large seed crops are produced by wild growing trees every 3-5 years (USDA, 1974). Seeds are collected in the fall and sown in flats to a depth of 1/4" and placed in the cold frame or cool greenhouse. Even under ideal conditions though, germination rates for true firs are usually low.

Few conifers are more beautiful or imposing than firs, and *Abies bracteata* is surely a regal member of this genus. Unfortunately, it can become very imposing in size — some garden plants in Britain reach 125', making them less suitable for home landscapes. Still, they would be magnificent specimens or groves for institutional or park landscapes. They appear to be drought tolerant and, in fact, may resent summer irrigation. Arboretum trees have successfully withstood several severe winters with little adverse effect. Following the extreme cold of February, 1989, with a record low temperature of 7° F, our trees suffered only slight needle burn. No insect or disease problems have been observed on those trees.

Driving along Highway 1 between Monterey and San Luis Obispo, you will see the chaparral-covered Santa Lucia mountains with the occasional dark patches of coniferous forest along the tops. Thomas Coulter, David Douglas, and others were probably guided to these bristle cone fir groves by the Franciscan Fathers of the Mission San Antonio who had long been using tree resin in religious ceremonies. To see native groves of *Abies bracteata* today, you must approach them from the east with the competent, albeit less pious, guidance of the U.S. Forest Service.

The bristle cone fir, *Abies bracteata*, is a worthy and handsome conifer for landscape use in the mild Pacific Northwest. Borrowing a summary from Donald Peattie, "No wonder that, in regions which can grow it, this is one of the most prized conifers, imparting to estate grounds an air of dignity and spaciousness; yet, from every needle reflecting light and cheer" (Peattie, 1953).

Barbour, M.G. & Major, J., Eds. 1988. Terrestrial Vegetation of California. California Native Plant Society #9.

Liu, T-S. 1971. A Monograph of the Genus Abies. Department of Forestry, National Taiwan University.

Peattie, D.C. 1953. A Natural History of Western Trees. Houghton Mifflin Co.

USDA 1974. Seeds of Woody Plants in the United States, Ag Handbook No. 450.

Parking

Parking is prepaid in University parking lots for Pro Hort.

Zoned Out on Hardiness

Dr. Clement Hamilton, Center for Urban Horticulture

"Seattle is, of course, in hardiness Zone 8." "Oh, yeah? We're in Zone 9!" "You're both nuts — we're Zone 5!"

So run similar discussions whose disagreement is grounded in the fact that not one, but three, hardiness zone systems are in common use in the western United States: the Arnold Arboretum, the USDA, and the Sunset systems. What are the differences?

The Arnold and USDA zone systems are similar in that they are based only on average annual minimum temperatures. They reflect the belief that low winter temperature is the most stressful condition that a plant can encounter, and limits the geographic range in which a plant can be grown successfully. The two systems differ in how they divide the range of minimum temperatures into distinct zones. The USDA does it by 10°F increments, while Arnold recognized greater sensitivity in the -10° to +10° range, so Zone 2 is -50° to -35° whereas Zone 5 is -10° to -5°. The two systems are summarized in Table 1. Notice that Arnold's Zone 4 is equivalent to USDA Zone 5, but that by Zone 8, the two systems are identical.

Their differences aside, neither system is satisfactory for North America west of the Great Plains, because other large-scale geographic factors begin to assert their importance. They include aridity (arid seasons of varying lengths, severity, and timing), elevation (which influences atmospheric pressure, which in turn affects plants' gas exchange), and potential evapotranspiration (the rate at which water is removed from the system). Eastern North America is relatively uniform in these factors, so the Arnold and USDA systems are useful, but they fail in the West, where mountain ranges, oceanic winds, and seasonally shifting atmospheric pressure zones make the prediction of plant success a risky business.

There are many localities in North America with low winter temperatures similar to those of Puget Sound. There are places with no arid season (Oklahoma City, with low rainfall; Tucumcari, NM, with high elevation; and Washington, D.C., with high rainfall); places with a 2-3-month arid season (such as Seattle); places with a 4-5-month arid season (Ashland, OR, with summer drought; and Roswell, NM, with winter drought); and places with as many as 10 arid months per year (Socorro, NM). These are all in the same zone by the two zone systems described above!

The editors of the Sunset Western Garden Book recognized this dilemma and enlisted the aid of climatologists and horticulturists in devising a hardiness zone system that would be useful in the West. Their 24 climate zones are based on latitude, elevation, temperature, and water balance, supplemented by the knowledge of successes and failures of selected "indicator plants." The result is arguably the best hardiness zone system now in use for landscape plants. This is not to say that conditions within a given zone are identical, however; Astoria, OR, and Seattle are both in Sunset Zone 5, but the former experiences less aridity in the summers.

One focus of research in the Hyde Hortorium at the Center for Urban Horticulture concerns plant hardiness or "physiological range." We are asking two questions: "For a given plant, which large-scale geographic factors are most important in determining success or failure? " and "Is there enough consistency among most plants to enable us to devise a more precise, predictive system?".

Until we have something better to go on, readers are advised strongly to use the Sunset system. Whatever you do, avoid confusion by identifying the system you're using: "Sunset Zone 5." "Oh, I thought you meant Arnold Zone 5!"

Table 1: Comparing USDA & Arnold

Zone	USDA	Arnold	Zone	USDA	Arnold
1	Below -50°F	Below -50°F	6	-10° to 0°	-5° to 5°
2	-50° to -40°	-50° to -35°	7	0° to 10°	5° to 10°
3	-40° to -30°	-35° to -20°	8	10° to 20°	10° to 20°
4	-30° to -20°	-20° to -10°	9	20° to 30°	20° to 30°
5	-20° to -10°	-10° to -5°	10	30° to 40°	30° to 40°

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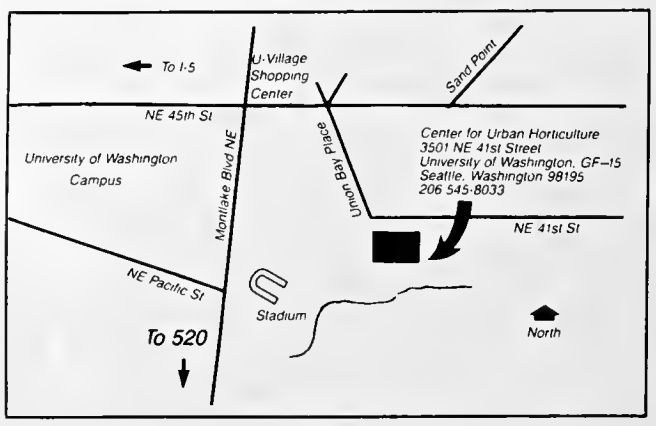

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